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Urban Earthquake Hazards: the Impact of Culture on Perceived Risk and Response in the USA and Japan

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This paper reports on a major survey of earthquake hazard response in neighbourhoods in Tokyo-Yokohama and Los Angeles, two metropolitan areas of highly industrialized nations which routinely exchange ideas in order to try to learn from the policies, practices and experiences of the other. Survey findings showed many similarities in hazard response and preferred public policy, but also important contrasts in behaviour, and significant differences in the factors associated with these behaviours. The findings suggest caution in bi-national pol- icy-sharing unless such sharing is preceded by a careful study of local cultural contexts

Keywords: cultural attitudes and values, earthquake hazard response, hazard mitigation, optimism, policy-sharing, risk perception

Soon after the Natural Disaster Reduction Initiative was added to the US-Japan Common Agenda for Cooperation in the Global Perspective in 1996, President Clinton and Prime Minister Hashimoto endorsed a bi-national symposium on earthquake policy which highlighted the importance of 'cooperative activities that could improve each country's earth- quake emergency policies and programs, and applications of research and technology'. This pioneering policy-sharing enterprise is both laudable and problematical: laudable because it gestures towards the positive objective of cross-national policy transfer, problematical because it sidesteps the practical issue of how to go about achieving that purpose. The variety of constraints to policy transfer need to be identified before such sharing will achieve its goals. The purpose of the research project reported here was to isolate national or cultural differences in attitudes towards earthquake risk, beliefs about appropriate government earthquake policy, and the adoption of household mitigation measures, insights necessary to illuminate some of the paths and also the roadblocks to cross- national policy transfer.

Universal or culturally specific principles

A great deal of behavioural science research has been aimed at identifying a set of 'universal' principles that people follow in making decisions under conditions of uncertainty such as environmental hazards. Among these decision principles are: cost-benefit calculations, subjective

calculations of expected utility, and decision heuristics. Among the latter are 'the gambler's fallacy' (the belief that if a low-probability event has occurred recently, it is unlikely to occur again soon after and therefore can be treated as an event with a probability of zero [Slovic et al., 1974]), the 'threshold' model (low probability events are reduced to zero [Slovic et al., 1977; Kahneman and Tversky,1979]), and 'anchoring and adjustment' (the tendency to estimate the loss at a particular level and then to adjust estimates around this first approximation no matter how inaccurate and biased the first estimate [Tversky and Kahneman, 1974; Einhorn and Hogarth, 1985]).

Individual decision-making also takes place within cultural contexts that constrain and enable the range of available choices, distorting the effects of 'universal' decision-making principles. The cultural context may, even in the absence of other factors, increase or reduce awareness of risk, and condition the range of acceptable responses (Wildavsky and Dake, 1990). A specific example is the case of 'optimism'. A number of studies have suggested that Americans estimate that they live longer than other people, that they are younger for their age than others, and that they are less likely to die from cardiovascular diseases or accidents (see Myers, 1993 for summary). Researchers have found an absence of this optimistic bias in self-perception among Japanese college students (Markus and Kitayama, 1991; Heine and Lehman, 1995), suggesting that this 'undue optimism' may not be a general human characteristic, but instead may be limited to certain culture groups, specifically European and American. Since a systematic difference in the degree of optimism about personal well-being could also affect perceived vulnerability and the propensity to take risk-mitigating actions, this notion of the predictive value of the 'optimistic bias' was one of the factors investigated in this study.

Empirical study

Previous research has pointed out that most deaths from earthquakes are the result of unsafe structures (Coburn and Spence, 1992; Alexander, 1993), and that it is the most economically and politically vulnerable residents who are also most likely to suffer the most from such events (Blaikie et al., 1994). Accepting this premise, the research reported here attempted to remove the effects of socioeconomic variability in the sample population of the two nations by comparing only owner-occupiers of single-family detached dwellings in highly hazard-prone metropolitan areas: Tokyo-Yokohama and Los Angeles.

Owner-occupiers of detached homes in California and Japanese were surveyed in 1994 and 1995 (Palm and Carroll, 1998). The study populations were selected to represent households living at relatively low density, with above-average incomes, and with investments in relatively expensive homes. The surveys were designed to measure several characteristics of the populations: (l) their general level of independence, interdependence and human agency/fatalism; (2) their perceptions of susceptibility to general risks; (3) their responses to the earthquake hazard; (4) the steps they as individuals and as members of their communities take to prepare for or mitigate against the negative effects of earthquakes; and (5) their recommendations concerning government

involvement in mitigation and disaster relief.

One of the key challenges in the research design was the development of questions that would represent the interests and values of both survey populations. Rather than develop questions in the USA and impose these questions in Japan, or vice versa, the questionnaire was developed in a two-stage process. First, in the spring of 1994, the research team met with focus groups in two California suburbs (Walnut Creek and Orange County) and in two cities in Japan (Yaizu and Shimizu) to develop a questionnaire. Participants were asked to list the primary worries facing themselves and their families, the images they have of the concept of 'earthquake', the probable effects of an earthquake in their community, and the behaviours they have adopted to mitigate risks. The open-ended questions were used to ensure that survey questions would include potential responses that were salient in both nations. The first draft of the full questionnaire was developed by the research team, translated and back-translated between English and Japanese. The questionnaire was administered in September and October of 1994 to approximately 1800 randomly sampled Californian owner-occupiers in three relatively homogeneous, low-density suburbs within the two large California metropolitan areas (Cupertino, Redlands and the western San Fernando Valley), to 800 non- randomly selected Japanese-Americans in the western San Fernando valley and to 2000 randomly selected Japanese homeowners in the Yokohama region (the wards of Tsurumi and Kanazawa) and in the Shizuoka region (the cities of Yaizu and Shimizu). The response rate in Japan was over 75 per cent, and in California it was over 60 per cent.

The Kobe (Great Hanshin) earthquake of January 1995 occurred immediately after the closure of the survey, and provided a natural laboratory to measure changes in attitudes and behaviours following a major earthquake. Therefore, all 1994 respondents were re- surveyed in the spring of 1995. There was little change in the response of the Californians between 1994 and 1995, but major changes in perceived risk among the Japanese respondents. In the remainder of this paper, the post-Kobe or 1995 responses for the western San Fernando Valley and the Kanazawa ward of Yokohama are reported.

Description of study areas

Responses of residents in two relatively low-density, suburban areas within the metropolitan regions of Los Angeles and Tokyo-Yokohama are reported here. The study region within Los Angeles was the western portion of the San Fernando Valley (Figure 1), a collection of subdivisions in the northern sector of Los Angeles County between the Santa Monica Mountains and the San Gabriel Mountains. The portions of this region that were sampled included census tracts in Reseda, West Hills, Chatsworth, Winnetka and Canoga Park. According to the 1990 Census of Population, these census tracts had a total population of just under 15,000 in 1990, of whom 84 per cent were 'white'. The average commuting time to work was just under 27 minutes each way, indicating that a large percentage of the population work outside their home neighbourhoods.

Residents of this area had experienced earthquake damage in January 1994 when a 6.7 earthquake caused an estimated US$30 billion in losses (Risk Management Solutions, I995a). Buildings within the western portion of the San Fernando Valley, including Chatsworth, Granada Hills and Woodland Hills were seriously damaged, although most of the wood-frame residential buildings 'performed quite well' despite losses of chimneys, broken glass and cracked plaster (Earthquake Engineering Research Institute, 1994: 45). Multi-storey buildings, particularly apartment complexes with tuck-under parking (so-called 'dingbat' housing), were seriously damaged.

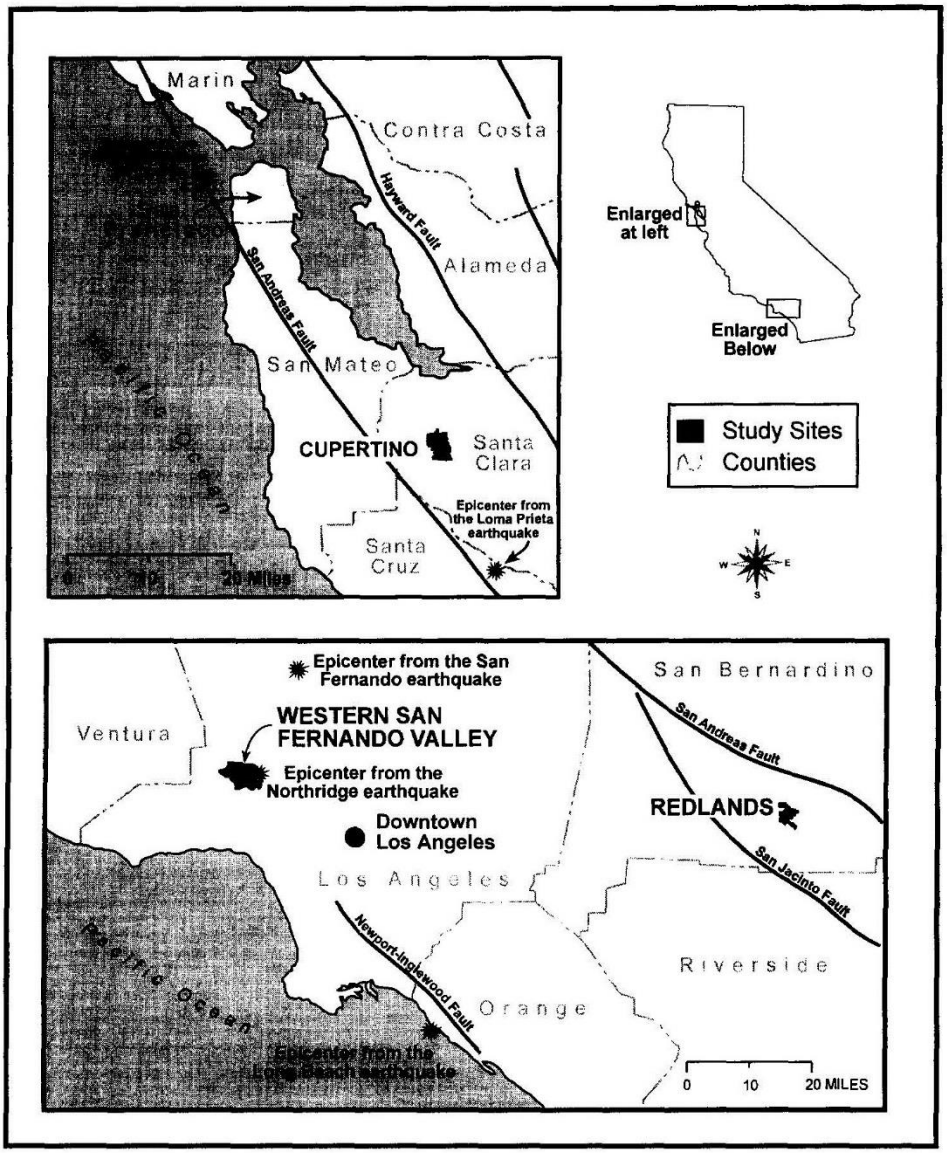

Figure 1 The San Fernando study area, California

But the risk of even greater damage and disruption looms large here. The San Fernando Valley is integrally tied to the Los Angeles metropolitan complex that would suffer immense losses in a major earthquake. Worst-case scenarios have been developed by state and national governments, and most recently by Risk Management Solutions (1995a), projecting staggering economic impacts. For example, a major earthquake on the Newport-Inglewood fault in Los Angeles would cause 2000 to 6000 deaths depending on the time of day of the occurrence, and vast economic impacts. The total economic loss would range from US$120 to 180 billion, with property losses due to shaking and fire ranging from US$60 to 95 billion.

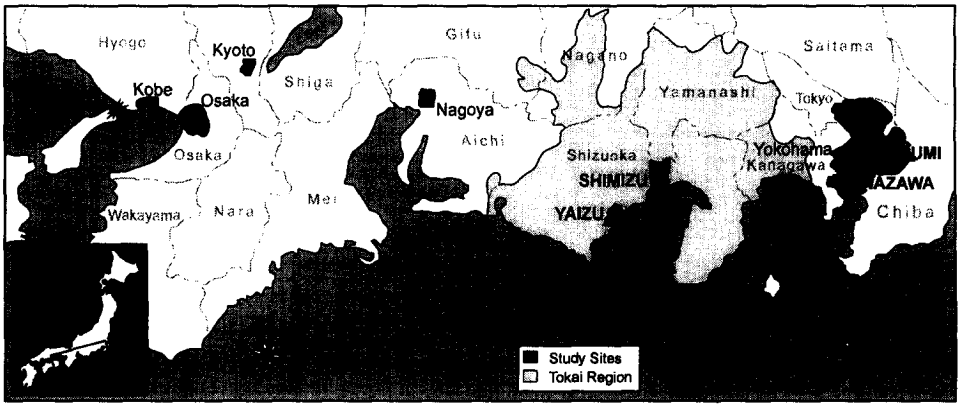

Figure 2 The Kanazawa study area, Yokohama, Japan

The Japanese study area (Figure 2) is a suburban ward (Kanazawa) within the Kanagawa prefecture which includes the City of Yokohama. With a population of 8 million, it is the third most densely settled prefecture in Japan. The area is developing rapidly, partly to house a population commuting to Tokyo, and partly in response to commercial and international investment to develop the city's waterfront district further.

The Kanazawa ward is on the southernmost part of the coast of the Kanagawa prefecture. It began rapid development in the late 1960s, becoming the destination for factories moving from central Yokohama (YOKE, 1994: 6). Residential and recreational development accompanied the extension of industry to Kanazawa, and in 1988 a 60 ha 'Marine Park' was opened. The Kanazawa ward is a neighbourhood of above-average educational attainment, home value and income. In comparison to other portions of the metropolitan area, the population lives at low density, particularly given the relatively larger concentrations of single-family dwellings in this district. However, even here, residential density is high by the standards of US suburbs, the average floor space per family unit being100.6 m^2 (1083 ft^2) per household in detached houses.

The entire Kanagawa prefecture is highly susceptible to earthquake damage. The Kanagawa government published expected losses associated with a 7.9 magnitude earthquake in the Kanagawa region. Such an earthquake would claim 14,000 lives, and result in the loss of over 600,000 buildings because of fire, and 365,500 buildings because of earth- quake shaking

(Kanagawa Prefecture, 1995). The area would also suffer from losses associated with a recurrence of the Great Kanto Earthquake of 1923. Risk Management Solutions (1995b) has estimated the total economic loss associated with such an earth- quake in the Tokyo metropolitan area (including the Kanagawa prefectures) to be US$2-3.3 trillion, and property losses due to shaking and fire exceeding US$1 trillion, more than ten times the losses of the projected Los Angeles earthquake.

In sum, both study areas are relatively affluent residential districts with populations that commute to business and industrial nodes within these great world cities. Both are also highly susceptible to major loss of life and property from an earthquake which is highly likely to occur within the next century.

General worries and perceived earthquake risk

Both study areas had experienced first hand or had witnessed news accounts of major earthquakes in their regions just months before the second survey. The western San Fernando valley had been the site of the 1994 Northridge earthquake. Although Kanazawa ward had not suffered damage from the Great Hanshin (Kobe) earthquake of 1995, the residents had seen graphic television and newspaper accounts of the death and destruction associated with it. However, when respondents were asked to indicate the problems they were most worried about, national differences were striking. Californians were most worried about crime, then deterioration of the family and the future of their children (Figure 3). Earthquakes were of concern, but far behind crime as a source of worry. The Japanese were most concerned about earthquakes, followed by pollution and then crime (the latter perhaps a result of the Sarin incident on the Tokyo subways that had occurred just months before the second survey). Deterioration of the family was of little concern to the Japanese respondents.

When asked specifically about their worries with respect to earthquakes, the Kanazawa respondents showed far greater concern than the residents of the western San Fernando Valley. In response to a direct question-'how worried are you about an earthquake affecting your community?'-the Kanazawa residents were very to extremely worried (4.1 on a 5-point scale) whereas the western San Fernando Valley residents were only moderately worried (3.4 on a 5-point scale).

Two questions were designed to elicit responses that could be interpreted as general measures of the estimated ability of respondents to control their own destiny. The first asked for agreement or disagreement (on a 4-point scale) with the statement that 'if an earthquake is going to harm me it will, and there isn't much that I can do about it- what will be, will be'. The second statement was: 'If an earthquake is going to occur, there is not much my city/community can do to lessen its effects'. Disagreement with each of these statements was interpreted as an empowered reaction to the environment: that the individual or city could do something to reduce the harm associated with earth- quakes. Although it might have been expected, from popular accounts of the contrasts

between American and Japanese culture, that the western San Fernando Valley residents were more likely to disagree with each of these statements, there was no statistically significant difference between the responses in the two study areas. Thus, although a simplistic 'cultural'

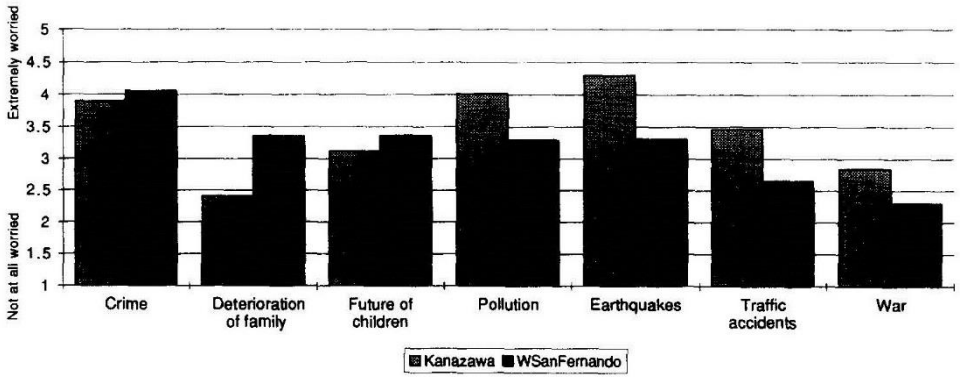

Figure 3 Contrasts in the general 'worries' of the residents of Kanazawa ward and western San Fernando Valley respondents

account might predict the existence of strong differences in attitudes, the two populations were indistinguishable in their general beliefs that individuals can not do much to prevent an earthquake from harming them, but that cities and communities can take actions to lessen the effects of earthquakes.

To summarize, earthquakes were the most important source of worry for the Japanese respondents, but not for the American respondents. Three possible explanations for these national differences in worry about earthquakes are suggested. First, because in Japan the population density is higher, and also the construction standards of single-family dwellings make families more susceptible to housing collapse, there may be an objectively higher risk and therefore good reason for the Japanese respondents to worry more about the impacts of an earthquake than the American respondents. Another possible explanation for the relatively lower level of worry about earthquakes in California could be that American society has been plagued by other, more immediate, societal problems, such as crime and family disintegration, than have the Japanese. Or, it could be that Japanese respondents simply express a higher degree of worry in general about all of the problems-in this survey, the mean level of overall worry was much higher in Japan than in the USA for the full set of problems. For whatever the reason or combination of reasons, the Japanese respondents viewed earthquakes as a far greater source of concern than did the American respondents.

Adoption of earthquake preparedness measures

Although the Japanese respondents were more worried about earthquakes than the California respondents, a larger percentage of Californians said they had adopted mitigation measures (Figure 4). More than 60 per cent of the residents of the western San Fernando Valley said they

had learned how to tum off their gas and other utilities, had stored food and water, had purchased a fire extinguisher, and had a first aid kit. In Kanazawa, the only two measures that more than 60 per cent of the households said they had done was to know how to tum off the utilities and possess a fire extinguisher. Few of the western San Fernando Valley respondents had participated in an earthquake drill, strengthened their homes or made plans to reunite the family after the emergency: in Kanazawa, few had strengthened their homes, bought earthquake insurance, had participated in drills, or had secured heavy furniture and appliances in their homes.

Reliance on government

The two study areas also differed with respect to preferred levels of government or community involvement in mitigation and emergency response. When asked, 'how much responsibility should the government, as opposed to each individual, have for protecting people from loss of life and damage to property from an earthquake?', the western San Fernando Valley respondents tended to prefer somewhat more individual than government involvement, whereas the Kanazawa respondents said somewhat more government than individual involvement. Similarly, the Japanese respondents were more likely than the Americans to prefer taxes to be raised to pay for new governmental activities to reduce the risks from earthquakes (Figure 5). The Kanazawa respondents were heavily in favour of taxes to be raised for stricter building codes, better

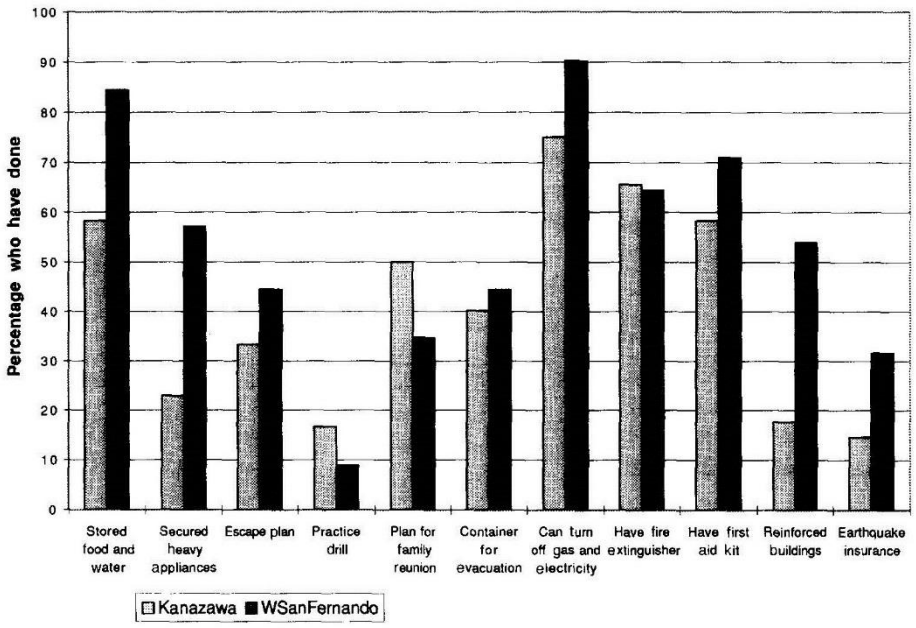

Figure 4 Percentage of the respondents who have adopted various mitigation measures

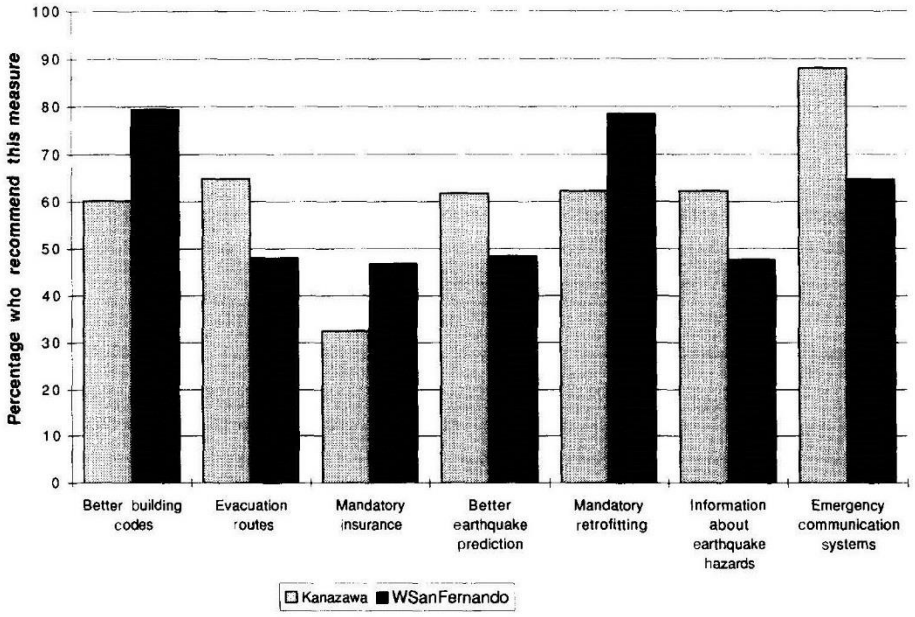

Figure 5 Percentage of the population who would support this public policy even if it meant higher taxes

planning for evacuation routes, research for better earthquake prediction, mandatory strengthening of public buildings, better earthquake public information programmes, and, most of all, for improvements in the emergency communication system at the time of the earthquake. The only measures favoured by a majority of the western San Fernando Valley respondents were increased taxes for better building codes, mandatory strengthening of public buildings and improvements to the emergency communication system.

Volunteerism in the two cultures

One of the questions probed the likelihood of spontaneous volunteerism following an earthquake. The question asked: 'If a strong earthquake hit your city and caused consider- able damage to your house, how willing do you think you would be to help others in your neighborhood?' Although a majority in both countries stated that they would be willing to help other people in the neighbourhood, this stated willingness to help others was much stronger in California than in Japan (Figure 6).

Several factors may account for these differences. First, these responses may reflect actual differences in cultural orientations, with the Japanese more willing to provide help to members of their own group, the 'in-group', and Americans less likely to draw such firm distinctions between in- and out-group membership. Or, alternatively, the responses may not reflect real differences, but instead represent differences in the way people speculate about their own

hypothetical behaviour. In this case, Americans may believe it to be 'right' to state that they would help other people, and to state this conviction whether or not it is actually true during and after such an event, whereas the Japanese respondent underestimates the actual amount of

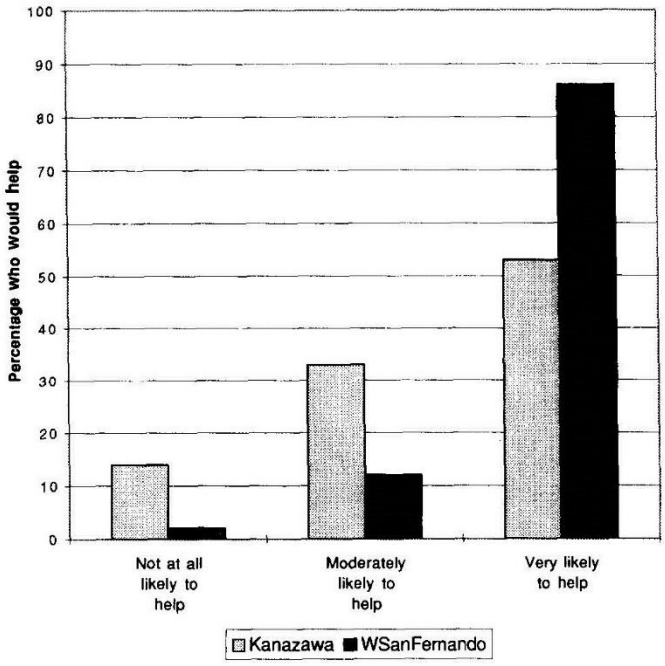

Figure 6 Percentage of the population who would help others in their neighbourhoods even if their own homes were also considerably damaged by an earthquake

help that he/she would provide in the event of an emergency. In any case, the differences in modal response by nation were striking, and merit further investigation. Empirically, in the event of a disaster, it does seem that Californians are more likely to organize easily into volunteer groups to provide help to strangers in the community, as was demonstrated in the contrasting responses of the general population in organizing voluntary and neighbourhood aid after the Northridge and Kobe earthquakes.

Optimism, maturity, and earthquake hazard response

To simplify, whereas control over one's own destiny is a culturally sanctioned value in the USA, 'maturity' and acceptance of destiny are preferred in Japan (Lebra, 1976; Takata, 1987; Kitayama and Markus, 1994; Palm and Carroll, 1998). In the USA, a ‘can do’ attitude, regardless of the real obstacles to tackling a problem, is seen as a positive personality characteristic, and one to be cultivated. In Japan, on the other hand, the acceptance of destiny is a culturally sanctioned value. This acceptance of destiny does not preclude efforts at self-improvement; instead, self-improvement is a sign of maturity that has to be cultivated throughout life. Thus, to agree with

statements of 'what will be, will be' in the USA is less an acceptance of reality, than an avoidance of responsibility to take actions to protect oneself. Disagreement with such statements is thus a 'predictor' of the propensity to take action. In Japan, this notion is unrelated to whether or not one will adopt mitigation behaviours: acceptance of destiny does not imply passive acceptance of ‘fate’, but instead a realistic assessment of elements that one cannot control. In Japan, age or maturity are the strongest predictors of mitigation behaviour: with increasing age comes increasing responsibility for the well-being of the self and the household.

It has already been noted that acceptance of destiny did not vary in frequency in the survey populations of the two study areas: the Kanazawa residents were no more likely to accept the notion of ‘what will be will be’ than the western San Fernando Valley residents. However, it was hypothesized that acceptance of this notion, along with the correlates of age or 'maturity' would affect patterns of the adoption of earthquake hazard mitigation behaviour within the study areas. This hypothesis was confirmed. Logistic regression analysis linking variables with the action of storing items in a container showed different predictor variables for California and Japan. A set of variables measured age category, income, experience with a previous frightening earthquake, and perceived vulnerability of the home to earthquake damage. Two measures of 'optimism' were also included-belief that one cannot do anything about earthquakes ('what will be, will be'), and belief in the ability of the household or community to lessen the effects of earth- quakes-were used to predict the adoption of mitigation measures. The most important predictor variables in the Yokohama wards for earthquake insurance adoption were family income, age of the homeowner and perceived vulnerability of the home. In the western San Fernando valley, income and perceived vulnerability were also important, but age was not related. Instead, belief about the ability of the household or community to lessen damage was an important correlate. Similar relationships were found for other mitigation measures, such as storing items in a container for possible evacuation and preparing the household with supplies of food, water and a first aid kit. Thus, whereas a sense of control over one's own destiny is a predictor of mitigation measure adoption in the California setting, 'maturity', a fundamental value of the Japanese Shinto cultural complex, is a predictor of hazard mitigation in the Yokohama suburb. Fundamental aspects of cultural values, quite apart from standard measures of income or experience with the hazard in the two nations, showed significant relationships with earthquake hazard response. This finding merits further investigation and elaboration in other contexts.

Public policy implications

A great deal of both popular and scholarly writing, sometimes aimed at American or European business travelers trying to understand the 'Japanese character', has simplified the presumed contrasts in general personality between Japanese and Americans, or 'westerners' and 'easterners'. Much of this writing has been properly criticized as unduly 'essentialist' for its quest for oversimplified and stereotypical contrasts in populations that actually have great commonalties. As critics of the 'essentialist' or *Nihonjihron* approach would suggest, there is considerable overlap in the populations. This study attempted to avoid the 'essentialist' trap. However, analysis

of the survey responses found that while some responses to the earthquake hazard were similar among the two nations, there were also significant differences between the Japanese and American responses to several of the questions, reflecting cultural constructs that differ from one country to another. These findings have important public policy implications for both nations.

Policy-makers in both countries will need to proceed cautiously in borrowing practices and policies from one context to another. The findings of the study reported here demonstrate that middle-class residents in these two suburban areas of major cities at risk from earthquake-related damage have adopted different types of household mitigation measures and also support different types of policy measures. Even more importantly, this analysis shows that different processes 'explain' these attitudes and behaviours. For example, whereas 'maturity' and the acceptance of the inevitability of the hazard are important predictors of mitigation behaviour in the Japanese cultural context, attitudes towards individual vulnerability and also estimates of the effectiveness of individual action are emphasized within the USA. It seems clear that carefully designed cross-national studies focusing on the historical, geographical and cultural factors that constrain and enable response will be needed if progress is to be made on developing and sharing effective common as well as localized earthquake hazard policy.

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